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The mediating effects of facial expression on spatial interference between gaze direction and gaze location.

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Running head: Facial expression and gaze direction

The mediating effects of facial expression on spatial interference between gaze direction and gaze location.

Gaze direction is an important social cue that interacts with facial expression. Cañadas and Lupiáñez (2012) reported a reverse-congruency effect such that identification of gaze direction was faster when a face was presented to the left but with the eyes directed to the right, or vice versa. In two experiments, this effect is replicated and then extended to explore the relationship between this effect and facial expression. Results show that the reverse-congruency effect is replicable with speeded gaze-direction identification, and that the effect is mediated by facial expression. The reverse-congruency effect is similar for happy and angry faces, but was not found for fearful faces. Findings are discussed in relation to the similarity of processing of incongruent gaze direction and the processing of direct gaze.

Keywords: Gaze direction; Emotional expression; Face processing; Eye contact; Reverse congruency effect.

The direction in which we perceive other people to be looking provides information about their focus of attention, their future actions and, generally provides an important cue in social interactions. People tend to direct their gaze to the object or location that others are gazing at, and this “joint attention” leads to faster processing of stimuli (e.g. Moore & Dunham, 1995). Perceived gaze automatically triggers visual attention shifts in the corresponding direction (Langton & Bruce, 1999; Law, Langton, & Logie, 2010). This gaze cueing effect has been suggested to involve the integrated perception of eye and head position (Langton, 2000).

Studies have, however, found inconsistent patterns of interaction between gaze direction and head orientation. Inconsistent gaze direction (e.g. the head turned to the left with the eyes directed to the right) interferes with judgements of head orientation (Langton, 2000), but judgements of gaze direction have been found to be enhanced when gaze and head orientation are inconsistent (Ricciardielli, Baylis, & Driver, 2000). Ricciardelli and Driver (2008) found that this reverse congruency effect only appeared when speeded responses were not required, and they argued that head orientation becomes relatively more important when speeded judgements are needed. With more speeded decisions under time pressure, they argued that only gross head orientation and gaze direction were coded in parallel to produce a ‘positive’ congruency effect. With an unspeeded task, utilising task instructions that did not emphasise speed of response, a trend towards a reverse congruency effect was observed. This did not, however, reach statistical significance. Further, this trend towards a reverse congruency effect was evident when only the eyes were visible in the absence of other facial features, and it reduced when other facial features were added.

Cañadas and Lupiáñez (2012) suggested that earlier studies, such as those of Ricciardelli and Driver (2008) did not control eye contact, and that there may be more rapid detection of gaze direction when gaze is directed towards the perceiver than when gaze is averted. In a series of experiments, they found a reverse congruency effect such that, for example, a face located on the left side of a computer screen but with eyes directed towards the right (i.e. towards the viewer) produced faster response times to identify the direction of the gaze compared with a face located on the left side and with gaze directed to the left. A key difference between this and earlier studies was that head orientation was held constant so that there were no cues to gaze direction other than the direction of the eyes.

Cañadas and Lupiáñez also found that this reverse congruency effect in the judgement of gaze direction was restricted to full-face stimuli and stimuli closely resembling eyes, and did not occur with inverted triangles arranged to resemble a face. With this type of non-social stimuli, a Stroop-like positive congruency effect was found. These findings also clearly contrast with those of Ricciardelli and Driver in that the reverse congruency effect was found in speeded tasks. Cañadas and Lupiáñez offer alternative explanations for their findings: (1) The incongruent gaze is perceived as being directed towards the viewer, and the social significance of such direct gaze increases the speed of the response, perhaps due to an anticipation of social interaction that such a gaze may signify in everyday life, (2) The incongruent gaze is perceived as being directed towards the centre of the screen rather than at the viewer, but as the viewer's initial attention is focused on the fixation point in the centre of the screen, this 'shared attention', again, speeds up the response.

One way of further exploring the mechanisms underpinning this reverse congruency effect is to explore the mediating effects of face emotionality. Gaze direction and emotional facial expression have been found to have complex interactive effects on the processing of emotionally relevant facial stimuli, and these raise a number of interesting possibilities. For example, in gaze-cueing tasks fearful faces have been shown to produce larger effects than happy faces (Putman, Hermans, & van Honk, 2006). Putman et al. suggest that this is due to the threat-signalling properties of a fearful face and the potential negative consequences of failing to attend to a threat that is signalled by another person's fearful gaze.

The time taken to make judgements of facial expression has also been found to be influenced by gaze. Adams and Kleck (2003), for example, found that such decisions were made more quickly when faces expressing anger or happiness were presented with gaze directed at the viewer than if the gaze was averted. Contrastingly, fear and sadness were recognised more quickly with averted gaze. Not only were expressions recognised more quickly in these combinations of expression and gaze direction, but the emotions expressed were rated as more intense. Adams and Kleck interpreted these findings in terms of a shared signal hypothesis, in which happiness and anger are considered to be ‘approach oriented’ emotions and sadness and fear ‘avoidance oriented’.

Not only does gaze direction influence the perception of expression, but the converse is also true. Adams and Franklin (2009) further investigated the relationship between emotion and gaze, and found that averted gaze was processed more quickly when coupled with a fearful expression, but direct gaze was processed more rapidly when the face showed anger. They suggest that direct gaze is more difficult to interpret when coupled with fear, but that this speculation required further corroborative research.

In terms of the reverse congruency effect reported by Cañadas and Lupiáñez (2012), if the gaze directed towards the centre of the computer screen is, indeed, construed by the viewer as directed towards them, then the reverse congruency effect should be enhanced for the ‘approach emotions’ of happiness and anger compared to the ‘avoidance emotions’ of fear or sadness. In sum, the interaction between emotion and gaze congruency should display the same pattern as that reported by Adams and Franklin (2009), with a reverse-congruency effect for angry faces, but not for fearful faces.

However, there is also the possibility that the relationship between gaze and emotionality is different from the explanation offered by Adams and Kleck (2003) or Adams and Franklin (2009). For example, Lobmaier and Perrett (2011) asked participants to judge whether faces presented in different orientations and with different facial expressions were looking towards them. They found that angry faces were the least likely to be judged to be “attending to me”. There was a strong positivity bias, such that faces with happy expressions were more likely to be judged to be looking at the viewer. This does not appear to be consistent with the shared signal hypothesis, and Lobmaier and Perrett suggest that their findings are consistent with the self-referential positivity bias (Pahl & Eiser, 2005). This is the idea that people generally have a motivation to maintain a positive self-concept, and so have a tendency to interpret positive emotions as directed towards them, and negative emotions as not being aimed in their direction. More particularly, people prefer to believe that they are the cause of another’s happiness, but not their anger or sadness. If this interpretation of the relationship between gaze and emotionality is correct, then it should follow that, in the type of task reported by Cañadas and Lupiáñez (2012), if the reverse congruency effect is attributable to the gaze being directed towards the viewer, then it should be enhanced when the target face displays happiness compared to a target face displaying anger or fear.

Both the shared signal hypothesis and the self-referential positivity bias would, therefore, suggest that happy faces should produce stronger reverse congruency effects than neutral or fearful faces. They would, however, suggest different outcomes for angry faces. If, as Cañadas and Lupiáñez suggest, the reverse congruency effect is due to the gaze being perceived as directed towards the viewer, then one of two possibilities occur for angry faces. If, as Adams and Kleck (2003) suggest, anger is an approach emotion, then angry faces should produce the same pattern of effects as happy faces. If, however, as Lobmaier and Perrett (2011) argue, angry faces are less likely to be perceived as directing their attention towards the viewer, then angry faces should produce results that are different from happy faces, and more similar to fearful faces.

The two experiments reported here were designed to firstly replicate the reverse congruency effect as reported by Cañadas and Lupiáñez (2012) and then to further explore the role of emotional facial expression in the processing of gaze, particularly with a view to exploring the two possibilities explained above.

Experiment 1

Experiment 1 was designed to replicate the reverse congruency effect reported by Cañadas and Lupiáñez (2012). As they employed a novel paradigm, it was important to establish that the effect was replicable before investigating further.

Method

Design

The independent variable in this experiment was the congruency between the gaze direction and the stimulus location. Stimuli were either congruent (e.g. presented on the left side of the screen with gaze directed to the viewer's left) or incongruent (e.g. presented on the left side of the screen with gaze directed to the viewer's right). The mean response time (RT) to correctly identify the direction of gaze was used as the dependent variable.

Participants

Valid consent was obtained from 34 students (27 females), with a mean age of 22.4 years, from Leeds Trinity University. They received partial course credit for participating. All participants had self-reported normal, or corrected to normal, vision.

Apparatus and Stimuli

In both of the experiments reported here, stimulus presentation, timing and data collection was controlled using E-Prime 2.0 (Schneider, Eschman, & Zuccolotto, 2002) run on a standard PC (Dell Optiplex 3010, 3.2 GHz, 8 GB RAM). Stimuli were presented on a 17" widescreen monitor with a 1024x768 pixel resolution. Responses were collected using a PST five-button Serial Response Box. The leftmost and rightmost buttons on the response box were configured to record 'left' and 'right' response, respectively.

Stimulus faces were selected from the Karolinska Directed Emotional Faces set (Lundqvist, Flykt, & Öhman, 1998). Four female and four male faces were selected, each with a neutral facial expression and each with their gaze directed towards the camera. These were then manipulated using Photoshop CS so that the gaze was directed to the left or right. Each image was 7.5 x 6.5 cm (180 x 200 pixels).

Procedure

In both of the experiments reported here, participants were seated approximately 60 cm from the computer screen. They were informed that the study was investigating how people process and identify the direction in which other people's eyes are looking, and that the task involved looking at a series of faces, presented one at a time, and identifying, as quickly and as accurately as possible, whether the face's eyes were looking to the left or right from the participant's point of view.

Each trial began with a white fixation cross presented in the centre of a green (to match the background of the stimulus images) screen for 500 ms. This disappeared simultaneously with the presentation of a stimulus face to the left or right of the screen. The distance from the fixation point to the centre of the stimulus was 11 cm. The stimulus remained on-screen until the participant made a response.

Participants were instructed to press the 'L' button on the response box if the eyes were directed to their left, and the 'R' button if the eyes were directed to the right. Instructions emphasised the need to respond as quickly and as accurately as possible. Ricciardelli and Driver (2008) found that the use of this type of instructions produced similar effects to the time-limiting of the stimulus display to further increase time pressure. The experiments reported here consequently make use of instructions to respond quickly but do not limit the on-screen presentation time of the stimulus.

Experiment 1 began with a practice block of 8 trials, with visual feedback provided after each trial informing participants whether the response had been correct. Following the practice block, participants undertook four experimental blocks, each of 32 trials, with a 30-second rest in-between each block. Each block of 32 trials contained each combination of stimulus face and congruency, presented on each side of the screen. The order of stimulus presentation was randomised for each participant.

Results

Times for incorrect responses were removed from the data and the median response time calculated for each participant for congruent and incongruent trials.

The data of four participants were removed prior to analysis. Two participants' accuracy rates were 44% and 49%, respectively, and inspection of their responses revealed that they had been incorrectly responding to the location rather than the gaze direction. All other participants had accuracy rates of at least 90%.

Two further participants had median response times that were considerably slower than the rest of the sample, with their medians falling more than twice the inter-quartile range from the medians for the sample. They were particularly slow in the congruent condition, so removing their data from the sample reduced the probability of a Type I error.

As there was no reason to suspect that there would be any effect of screen position on response times, or any interaction between screen position and congruence, screen position was not included as a variable in the analysis.

A paired-samples t test revealed that mean response times to congruent stimuli (M=591, SD=70.5, 95% CI [564, 617]) were significantly slower than the response times to incongruent stimuli (M=576, SD=82.4, 95% CI [546, 607]), $t(29) = 2.32$, $p = .03$, $d = .42$.

Discussion

The findings of Experiment 1 support the hypothesis that response times to stimuli would be faster when the spatial location of the face and the gaze direction were incongruent. The means are similar to those reported by Cañadas and Lupiáñez (2012) in their Experiment 1, for stimuli with an onset time of zero (i.e. when the face was presented on-screen using the same timings as in the present experiment). It is also important to note that this effect was observed in a speeded task, insofar as the task instructions emphasised a need to respond as quickly as possible, again replicating the findings of Cañadas and Lupiáñez and in contrast to those of Ricciardelli and Driver (2008), although, as noted earlier, Ricciardelli and Driver's findings related to head orientation and gaze direction rather than to stimulus location. That notwithstanding, however, it appears, that the reverse congruency effect for the processing of gaze direction reported by Cañadas and Lupiáñez (2012) is replicable and merits further investigation.

Experiment 2

The second experiment investigated the effects of emotion in the reverse-congruency effect found in Experiment 1.

Design

A 4x2 experimental design was used, with four levels of emotional facial expression (neutral, happy, angry, and fearful), and two levels of congruency, as in Experiment 1. The dependent variable was, again, the mean RT to correctly identify the direction of gaze.

Participants

Valid consent was obtained from 30 students (19 females), with a mean age of 21.1 years, from Leeds Trinity University. They received partial course credit for participating. All participants had self-reported normal, or corrected to normal, vision. None of the participants had taken part in Experiment 1.

Apparatus and Stimuli

Stimulus faces were again selected from the Karolinska Directed Emotional Faces set (Lundqvist, et al., 1998). Two male and two female faces were selected from the set. Each of the four individuals was selected to ensure that their eyes were clearly visible when displaying each of the four facial expressions (neutral, happy, angry and fearful). A group of 22 participants (none of whom participated in either experiment reported here) was asked to identify the emotion being displayed within each of the 16 images, to ensure that the faces were perceived as showing the intended emotion.

As the original images all had direct gaze, these were manipulated using Photoshop CS so that the gaze was directed to the left or right. Each image was 7.5 x 6.5 cm (180 x 200 pixels).

In order to avoid confounding facial expression with the area of the eye visible to the viewer, faces were selected that did not have exaggerated changes in the eyes between the emotions being expressed (e.g. the narrowing of eyes with anger, or the widening of eyes with fear). Following manipulation of the images to alter the direction of gaze, the mean number of pixels representing the visible eye area was calculated for each emotion. There was very little difference in the number of pixels representing each eye for each of the four emotions. The means ranged from 114.25 (SD= 19.6) for neutral expressions to 119.25 (SD=13.1) for fearful faces. Further, care was taken to ensure that the white of the eye occupied an equivalent proportion of the eye for each of the four conditions. The white occupied between 42.2% (fearful faces) and 43.8% (neutral faces) of the visible eye area, thus ensuring that the visible characteristics of the eye were not confounded with the emotion displayed by the face.

Procedure

The procedure was mainly the same as in Experiment 1. In Experiment 2, though, the block of 8 practice trials was followed by two experimental blocks, each of 64 trials. Each of the two blocks included every combination of face, emotion, eye direction and screen position, presented in a different randomised order to each participant. As in Experiment 1, instructions emphasised the need to respond quickly.

Results

Data for the practice block were not analysed, and response times for incorrect responses in the experimental blocks were not included in the analysis.

A median response time for correct responses was calculated for each participant for each combination of emotion and congruence. The means of these medians are presented in Figure 1.

(Figure 1 about here)

A 4 (emotion: happy, angry, fearful, neutral) x 2 (congruency: congruent vs incongruent) repeated-measures analysis of variance was performed on the RT data. This showed a significant main effect of congruence $F(1, 29) = 21.23$, $p < .001$, $\eta_p^2 = .42$, with shorter RTs for responses to incongruent (M = 552, SD = 85.3) than congruent stimuli (M = 574, SD = 84.1).

There was no main effect of emotion ($F < 1$), but the interaction between emotion and congruency was significant, $F(3, 87) = 3.46$, $p =.02$, $\eta_p^2 = .11$. Paired-samples t tests were used as tests of simple effects to explore the interaction. A Bonferroni adjustment was applied in order to maintain the family-wise error rate at .05. Consequently, an alpha level of .0125 was used for these analyses. These revealed that there was a statistically significant advantage in terms of shorter RTs for incongruent stimuli for happy, $t(29) = 3.78$, $p < .001$, $d = .69$, and angry, $t(29) = 4.44$, $p < .001$, $d = .81$, but not for neutral $t(29) = 2.10$, $p = .04$, $d = .38$, or fearful faces, $t(29) = 1.76$, $p = .09$, $d = .32$.

Discussion

The findings of Experiment 2 demonstrate an interaction between congruency and emotional expression. The reverse-congruency effect between gaze direction and spatial location is again evident, but its strength varies depending on emotional expression. Interestingly, the reverse-congruency effect is stronger for faces displaying happiness or anger than for faces with neutral or fearful expressions.

Reassuringly, the effect size (*d*) for neutral faces in Experiment 2 ($d = .38$) was similar to that observed in Experiment 1 ($d = .42$), as well as the effect size for the comparable condition in Experiment 1 reported by Cañadas and Lupiáñez (2012) ($d = .39$), suggesting that the reverse-congruency effect is fairly stable in magnitude for neutral faces when presented as static images. In Experiment 2, though, it should be noted that this effect did not reach statistical significance, apparently due to the conservative use of the Bonferroni adjustment of the alpha level for the post hoc t tests.

The interaction between emotion and congruency is interesting. The patterns of results for happy and angry faces were similar and, in both cases, a reverse-congruency effect was observed, and the effect size for this was larger than for neutral faces. The neutral and fearful faces did not produce significant congruency effects. This does not seem to be consistent with the reverse-congruency effect being due to shared attention, with the incongruent gaze focused on the centre of the screen where the viewer's attention is initially directed. Fearful faces have been shown to produce larger effects than happy faces in gaze-cueing tasks (Putman, Hermans, & van Honk, 2006), so it does not appear as though the task used here, and by Cañadas and Lupiáñez (2012), is mimicking a gaze-direction task. Rather, it does seem more likely that the effect is explained by the first suggestion of Cañadas and Lupiáñez (2012), that the incongruent gaze is perceived as being directed towards the viewer. The largest reverse-congruency effect was observed for angry and happy faces, and this similarity between the responses to these two emotions suggests that, in this task at least, they are processed in the same way. This is consistent with the suggestion of Adams and Kleck (2003), that both anger and happiness are 'approach emotions', and so responses to them are speeded by the perception that these emotions are directed towards the viewer. They found, as they predicted, that direct gaze would facilitate the processing of anger and joy, as reflected by facial expression, and that averted gaze would facilitate the processing of fear. As, in the present experiment, response was not facilitated by a face with a fearful expression, it suggests that the incongruent gaze was not perceived as averted but was, rather, perceived as directed towards the viewer.

The self-referential effect discussed by Lobmaier and Perrett (2011) does not seem to have come into play in this experiment. According to Lobmaier and Perrett, people have a tendency to interpret anger as not being directed towards them which, in this case, would have produced a disparity between participant responses to happy and angry faces. The relative sizes of the reverse-congruency effect for happy and angry faces suggest that, not only were angry faces perceived as directed towards the viewer, but that these also shortened response times.

The pattern of findings is similar to that reported by Adams and Franklin (2009), although there are some key differences. Adams and Franklin found that direct gaze was identified more quickly when the face displayed anger compared to when it displayed fear, and the same effect is evident with the results of Experiment 2, reported here. The findings of Adams and Franklin, that indirect gaze was identified more quickly for fear than for anger, was not supported, as the response times for fear were only slightly shorter. The key difference between the Adams and Franklin findings and the results reported here are that Adams and Franklin's experiments compared faces with direct gaze with faces with averted gaze, presented in the centre of the screen. As Adams and Franklin point out, when this type of paradigm is used, the whites of the eyes are accentuated by averted eye gaze, and this may, therefore, offer an easily identified physical cue to gaze direction. In the two experiments reported here, however, this potentially powerful cue to gaze direction was removed by presenting the faces to the left or right of the fixation point and, further, by ensuring that the whites of the eyes were equally visible for all of the emotions. Also, of course, the purpose of these experiments was to explore the suggestion by Cañadas and Lupiáñez (2012) that the reverse congruency effect was due to the incongruent gaze direction being perceived as being directed towards the viewer. This means, therefore, that the notion of direct gaze cannot be presumed, as in the Adams and Franklin studies. It seems reasonable to suggest that an incongruent gaze being perceived as a direct gaze would not be as immediately perceptible or as powerful as a 'true' direct gaze in which the eyes are directed at the camera. Adams and Franklin, again, suggest that the processing of the whites of the eyes occurs at the earliest stages of visual processing, which may help to explain the findings of studies comparing direct and averted gaze with centre-of-screen presentations of stimuli. In the present experiments, the extent to which the whites of the eyes were visible was identical for both congruent and incongruent gaze direction, so this was not a useful cue in judging gaze direction in this task where the combination of gaze direction and gaze location were important.

In light of the patterns of findings reported here, can it be assumed that a face presented to the side of the screen, but with eyes directed to the centre of the screen is processed in the same way as a face presented centrally, but with eyes directed straight out towards the viewer? The differences in response time for faces showing different emotions, for congruent and incongruent gaze directions are similar to the patterns found in previous studies exploring the interaction between emotion and gaze direction for averted and direct gaze (e.g. Adams & Kleck, 2003). The partial discrepancy between these findings and those reported by Adam and Frankilin (2009) may be partly explained by the removal of the whites of the eyes as a cue to gaze direction, which may be a valuable feature of the paradigm presented by Cañadas and Lupiáñez (2012).

In sum, the current work demonstrated that there is an interaction between facial expression and the reverse-congruency effect reported by Cañadas and Lupiáñez (2012). The pattern of results suggest that the reverse-congruency effect may be due to the incongruent gaze being processed as though it is direct gaze, and that the influence of facial emotional expression on the processing of gaze is consistent with anger and happiness being processed under these circumstances as 'approach emotions' (Adams & Kleck, 2003). The evidence provided here does not support a self-referential effect of emotion, (Lobmaier & Perrett, 2011), neither does the reverse-congruency effect appear to be a function of gaze-cueing (Putman, Hermans, & van Honk, 2006). The current work establishes the robustness of the reverse-congruency effect in the processing of gaze direction, in a speeded task, but a fuller understanding of the similarities and differences between the processing of incongruent gaze and direct gaze will help to further elucidate the role of emotion in processing gaze direction as a social cue.

References

Adams Jr., R. B., & Franklin Jr., R. G. (2009). Influence of emotional expression on the processing of gaze direction. *Motivation & Emotion*, *33*(2), 106-112. doi:10.1007/s11031-009-9121-9

Adams Jr., R. B., & Kleck, R. E. (2003). Perceived gaze direction and the processing of facial displays of emotion. *Psychological Science*, *14*(6), 644-647.

Cañadas, E., & Lupiáñez, J. (2012). Spatial interference between gaze direction and gaze location: A study on the eye contact effect. *Quarterly Journal of Experimental Psychology*, *65*(8), 1586-1598.

Langton, S. R. H. (2000). The mutual influence of gaze and head orientation in the analysis of social attention direction. *Quarterly Journal of Experimental Psychology*, *53A*(3), 825-845.

Langton, S. R. H., & Bruce, V. (1999). Reflexive visual orienting in response to the social attention of others. *Visual Cognition*, *6*(5), 541-567.

Law, A. S., Langton, S. R. H., & Logie, R. H. (2010). Assessing the impact of verbal and visuospatial working memory load on eye-gaze cueing. *Visual Cognition, 18*(10), 1420-1438.

Lobmaier, J. S., & Perrett, D. I. (2011). The world smiles at me: Self-referential positivity bias when interpreting direction of attention. *Cognition and Emotion*, *25*(2), 334-341.

Lundqvist, D., Flykt, A., & Öhman, A. (1998). The Karolinska Directed Emotional Faces - KDEF, CD ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institutet, ISBN 91-630-7164-9.

Moore, C., & Dunham, P. J. (1995). *Joint attention: Its origins and role in development.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Pahl, S. & Eiser, J. R. (2005). Valence, comparison focus and self-positivity biases: Does it matter whether people judge positive or negative traits? *Experimental Psychology, 52*, 303-310.

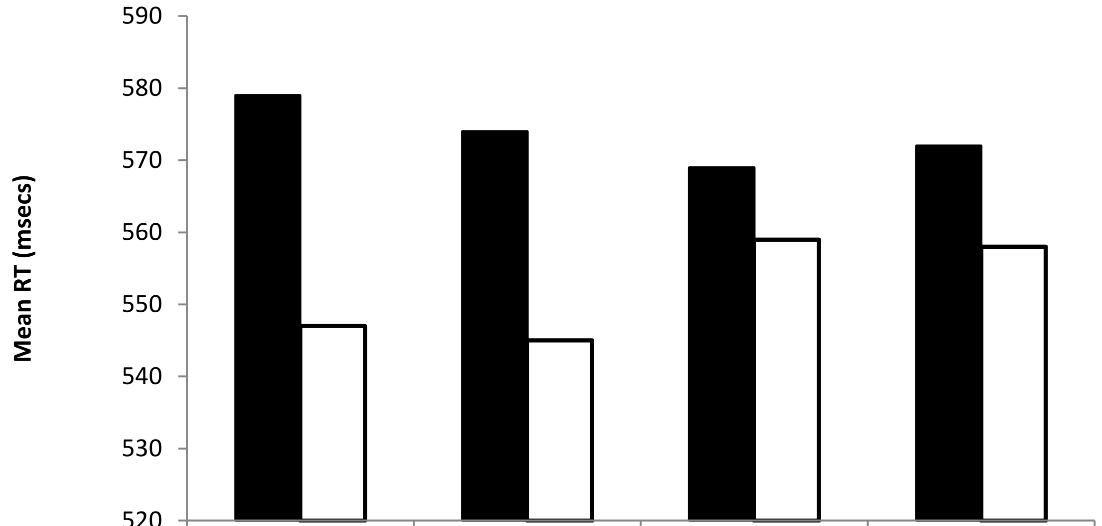
Putman, P., Hermans, E., & van Honk, J. (2006). Anxiety meets fear in perception of dynamic expressive gaze. *Emotion*, *6*(1), 94-102.

Ricciardelli, P., Bayliss, G., & Driver, J. (2000). The positive and negative of human expertise in gaze perception. *Cognition*, *77*, B1-B14.

Ricciardelli, P., & Driver, J. (2008). Effects of head orientation on gaze perception: how positive congruency effects can be reversed. *Quarterly Journal of Experimental Psychology, 61*(3), 491-504.

Schneider, W., Eschman, A., & Zuccolotto, A. (2002) E-Prime User's Guide. Pittsburgh: Psychology Software Tools Inc.

Figure 1. Means of median response times (ms) by emotion and gaze congruence



	Happy	Angry	Fearful	Neutral
■ Congruent	579	574	569	572
□ Incongruent	547	545	559	558